

## NATURAL RESOURCES CONSERVATION SERVICE CONSERVATION PRACTICE STANDARD

### NUTRIENT MANAGEMENT

(Acre)  
Code 590

#### DEFINITION

Managing the amount, source, placement, form and timing of the application of nutrients and soil amendments.

#### PURPOSES

This practice may be applied as part of a resource management system to support the following purposes:

- To budget and supply nutrients for plant production.
- To properly utilize manure or organic by-products as a plant nutrient source.
- To minimize agricultural non-point source pollution of surface and ground water resources.
- To maintain or improve the physical, chemical and biological condition of soil.

#### CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all lands where plant nutrients and soil amendments are applied.

#### CRITERIA

##### General Criteria Applicable to All Purposes

Plans for nutrient management shall comply with all applicable Federal, tribal, state, and local laws and regulations (see Section I, General Resource References, Field Office Technical Guide (FOTG)).

Plans for nutrient management shall be developed in accordance with policy requirements of the NRCS General Manual Title 450, Part 401.03 (Technical Guides, Policy and Responsibilities) and Title 190, Part 402 (Ecological Sciences, Nutrient

Management, Policy); technical requirements of the NRCS Field Office Technical Guide; procedures contained in the National Planning Procedures Handbook (NPPH), and the NRCS National Agronomy Manual (NAM) Section 503.

♦ Persons who review or approve plans for nutrient management shall be certified conservation planners, as per 180 General Manual, Part 409. Plans for nutrient management that are elements of a Resource Management System (RMS) Plan or Comprehensive Nutrient Management Plan (CNMP) for livestock operations, shall recognize other requirements of the RMS or CNMP and be compatible with those requirements.

A nutrient budget for nitrogen (N), phosphorus (P), and potassium (K) shall be developed that considers all potential sources of nutrients including, but not limited to:

- animal manure and organic by-products
- waste water,
- commercial fertilizer,
- soil residual levels (Nitrate-N, Ammonium-N, Organic Matter),
- crop residues,
- legume credits,
- irrigation water, and
- precipitation

Realistic yield goals shall be established based on soil productivity information, historical yield data, actual production history, certified producer records, climatic conditions, level of management and/or local research on similar soil, cropping systems, and soil and manure/organic by-products tests. For new crops or varieties, industry yield estimates may be used until documented yield information is available.

Plans for nutrient management shall specify the form, source, amount, timing and method of application of nutrients on each field to achieve realistic production goals, while minimizing nitrogen and/or phosphorus movement to surface and/or ground waters.

Erosion, runoff, and water management controls shall be installed to meet Section III, Quality Criteria, Field Office Technical Guide on fields that receive nutrients. Wind and/or water erosion prediction tools will be used to predict soil loss and management criteria for fields on which nutrients are applied.

### **Soil Sampling and Laboratory Analysis (Testing)**

Nutrient planning shall begin with current soil test results that are developed in accordance with Pacific Northwest (PNW) Land Grant University guidance or industry practice if recognized by the PNW Land Grant University. Soil tests must be used to effectively plan for nutrient application. Current soil tests for nitrogen, phosphorus, and potassium are those that are no older than three years for perennial crops and one year for annual crops. If a current soil test is not available one will be completed within 12 months of developing the plan. More frequent soil sampling and analysis may be required on existing or planned crop rotations with identified resource concerns. In areas where precipitation is greater than or equal to 25", an end of season soil nitrate-N sample and analysis will be taken to evaluate N management levels for the previous year on fields where manure and other organic-by-products are applied. Nitrate-N values will be evaluated using the current version of Agronomy Technical Note # 35. The end of season soil nitrate-N sampling will continue until management in the top two feet of the soil profile indicates nitrate-N levels equal to or below 40 lbs. per acre and no additional nitrogen applications will occur that year.

Regular testing for soil nutrient availability is essential for proper nutrient management decisions making. Soil tests should be completed as close as possible to time of seeding for best results.

Soil samples shall be collected and prepared according to the PNW Land Grant University guidance. Laboratories from the WCC-103

Region enrolled in the North American Proficiency Testing Program shall perform the soil test analyses.

Soil testing shall include analysis for any nutrients for which specific information is needed to develop the nutrient plan. At a minimum, request analyses pertinent to monitoring or amending the annual nutrient budget for pH, electrical conductivity (EC), soil organic matter, nitrate-N, ammonium-N, phosphorus ( $P_2O_5$ ), and potassium ( $K_2O$ ).

### **Plant Tissue Testing**

Tissue sampling and testing, where used, shall be done in accordance with PNW Land Grant University standards or recommendations.

### **Nutrient Application Rates**

Soil amendments shall be applied, as needed, to adjust soil pH to the specific range of the crop for optimum availability and utilization of nutrients.

Recommended nutrient application rates shall be based on PNW Land Grant University guidelines which consider current soil test results, realistic yield goals and management capabilities. If the PNW Land Grant Universities do not provide specific nutrient management guidelines, application shall be based on realistic yield goals, current soil tests and associated plant nutrient removal rates.

Plant removal rates recognized by NRCS may be found in the Agricultural Waste Management Field Handbook (AWMFH), Table 6-6. When plant removal rates are not available the NRCS State Agronomist shall be contacted for assistance in developing nutrient management guidelines.

The planned rates of nutrient application, as documented in the nutrient budget, shall be determined based on the following guidance:

- **Nitrogen Application** - Planned nitrogen application rates shall match the recommended rates as closely as possible, except when manure or other organic by-products are a source of nutrients. When manure or other organic by-products are a source of nutrients, see "Additional Criteria" below.
- **Phosphorus Application** - Planned phosphorus rates shall match the

recommended rates as closely as possible, except when manure or other organic by-products are a source of nutrients. When manure or other organic by-products are a source of nutrients, see “Additional Criteria” below.

- **Potassium Application** - Excess potassium shall not be applied in situations in which it causes unacceptable nutrient imbalances in crops or forages. When potassium grass-forage concentrations reach ranges between 3.5 to 6% of diet dry matter and make up a major portion of the diet, management practices will be utilized to reduce forage potassium concentrations.
- **Other Plant Nutrients** - The planned rates of application of other nutrients shall be consistent with PNW Land Grant University guidance or industry practice if recognized by the PNW Land Grant Universities.
- **Starter Fertilizers** - Starter fertilizers containing nitrogen, phosphorus, and potassium may be applied in accordance with PNW Land Grant University recommendations or industry practice when recognized by the PNW Land Grant Universities. When starter fertilizers are used, they shall be included in the nutrient budget.

#### **Nutrient Application Timing**

Timing and method of nutrient application shall correspond as closely as possible with plant nutrient uptake characteristics, while considering cropping system limitations, soil and water limitations, weather and climatic conditions, phosphorus, leaching and runoff indices, and field accessibility.

#### **Nutrient Application Methods**

Nutrients shall not be applied to frozen, snow-covered ground or saturated soil if a potential risk of discharge to ground or surface waters exists. Assessment tools to determine the potential risk of runoff or leaching are the phosphorus, leaching and runoff indices and Table 5.3, Chapter 5, Role of Soils in Waste Management, AWMFH.

Nutrient applications associated with irrigation systems shall be applied in accordance with

the requirements of Section IV, FOTG, Practice Standards, Irrigation Water Management (Code 449).

#### **Additional Criteria Applicable to Manure or Organic By-Products Applied as a Plant Nutrient Source**

Nutrient Management (590) is a component of a Resource Management System that includes the structural, vegetative, and management practices necessary to safely collect, treat, store, transfer and use manure and organic by-products. Nutrient values of manure and organic by-products (excluding bio-solids) shall be determined prior to land application based on laboratory analysis, acceptable “book values” recognized by the NRCS, or historic records for the operation, if they accurately estimate the nutrient content of the material.

Field sampling of stored manure tends to be highly variable. Large numbers of samples are necessary for accurate estimates of nutrient content. Consult an NRCS agronomist or a Cooperative Extension Service specialist before designing a sampling scheme. Book values recognized by NRCS may be found in Chapter 4, Waste Characteristics, of the AWMFH.

#### **Nutrient Application Rates**

The application rate (in/hr) for material applied through irrigation shall not exceed the soil intake/infiltration rate. The total application shall not exceed the field capacity of the soil.

The planned rates of nitrogen and phosphorus application recorded in the plan shall be determined based on the following guidance:

- **Nitrogen Application** - When determining allowable nutrient application rates from manure or other organic sources, nitrogen may be applied based on crop nitrogen needs for the portion of the crop year remaining. In most cases, this will allow application of more phosphorus and potassium than required by the crop. This may continue as long as the risk of phosphorus moving to surface or groundwater (based on the Phosphorus Index) is low or medium.
- When the plan is being implemented based on crop removal rates for

phosphorus, manure or other organic by-products shall be applied at rates consistent with phosphorus recommendations. In such situations, an additional nitrogen application, from non-organic sources, may be required to supply the recommended amounts of nitrogen.

- Manure or other organic by-products may be applied on legumes at rates equal to the estimated removal of nitrogen in harvested plant biomass. Book values recognized by NRCS may be found in Table 6.6, Chapter 6, Role of Plants, Agricultural Waste Management Field Handbook.
- Phosphorus Application - When manure or other organic by-products are used, the planned rates of P application shall be consistent with the Phosphorus Index Rating.
- Phosphorus Index (PI) Rating. Nitrogen based manure application on Low or Medium Risk Sites.

If a field is rated High or Very High Risk by the Phosphorus Index:

- a. Manure or organic by-products may be applied to meet the crop removal rates for phosphorus for the planned crop rotation.
- b. Conservation practices and/or phosphorus reduction management practices are adopted to reduce the risk of phosphorus movement..
- c. Manure or organic by-products will be applied on sites considered vulnerable to off-site phosphorus transport unless appropriate conservation practices, best management practices, or management activities are used to reduce the vulnerability.

A current phosphorus soil test shall be used in determining the PI rating. Western Washington will use the Bray P1 test and in eastern Washington the Olsen test is recommended.

A single application of phosphorus applied as manure may be made at a rate equal to the recommended phosphorus application or

estimated phosphorus removal in harvested plant biomass for the crop rotation or multiple years in the crop sequence. When such applications are made, the application rate shall:

- not exceed the recommended nitrogen application rate during the year of application, or
- not exceed the estimated nitrogen removal in harvested plant biomass during the year of application when there is no recommended nitrogen application.
- not be made on sites considered vulnerable to off-site phosphorus transport (High or Very High sites) unless appropriate conservation practices, best management practices, or management activities are used to reduce the vulnerability.

#### **Field Risk Assessment**

When animal manure or other organic by-products are applied, a field-specific assessment of the potential for nitrogen and phosphorus transport from the field shall be completed. This assessment will be completed using the Leaching and Runoff Index (Water Quality Technical Note # 3, the Phosphorus Index (Water Quality Technical Note # 2), Table 5.3, Chapter 5, Role of Soils in Waste Management, AWMFH, or other recognized assessment tools. In such cases, plans shall include:

- a record of the assessment rating for each field or sub-field, and
- information about conservation practices and management activities that can reduce the potential for N and P movement from the site.

When such assessments are made the results of the assessment and recommendations shall be discussed with the producer during the development of the plan.

#### **Heavy Metals Monitoring**

When bio-solids are applied, the accumulation of potential pollutants (including arsenic, cadmium, copper, lead, mercury, selenium, and zinc) in the soil shall be monitored in accordance with the US Code, Reference 40

CFR, Chapter 173-308, WAC, Biosolids Management, and other applicable state and local laws or regulations.

**Additional Criteria to Minimize Agricultural Non-point Source Pollution of Surface and Ground Water Resources**

Areas designated as impaired for nutrients or organic-by-products are identified in Section I of the Field Office Technical Guide. In areas with an identified or designated nutrient-related water quality impairment, an assessment shall be completed of the potential for nitrogen and/or phosphorus transport from the field.

The Leaching, Runoff, Phosphorus Indices, or other recognized assessment tools shall be used to make these assessments. The results of these assessments and recommendations shall be discussed with the producer and included in the plan.

Plans developed to minimize agricultural non-point source pollution of surface or ground water resources shall include practices and/or management activities that can reduce the risk of nitrogen or phosphorus movement from the field.

**Additional Criteria to Improve the Physical, Chemical, and Biological Condition of the Soil.**

Nutrients shall be applied in such a manner as not to degrade the soil's structure, chemical properties, or biological condition or reduce crop yields below the producers desired goals. Use of nutrient sources with high salt content will be minimized to maintain a favorable salt balance in the crop root zone. Excess salts and nutrients may collect in shallow, unprotected aquifers as well as in irrigation return flows to surface waters. Carefully manage contaminated supplies to prevent further accumulation of salts. The State of Washington Irrigation Guide, Table WA682.40.1 provides general guidance for salinity.

Nutrients shall not be applied to flooded or saturated soils when the potential for soil compaction and creation of ruts is high.

Manure and other organic-by-products applied to improve soil tilth shall be evaluated using the most current version of Agronomy Technical Note # 1, the Soil Condition Rating.

**CONSIDERATIONS**

Consider induced deficiencies of nutrients due to excessive levels of other nutrients.

Consider additional practices such as Waste Utilization (633), Conservation Cover (327), Grassed Waterway (412), Contour Buffer Strips (332), Filter Strip (393), Irrigation Water Management (449), Riparian Forest Buffer (391A), Conservation Crop Rotation (328), Cover Crops (340), and Residue Management (329A, 329B, or 329C, and 344) to improve soil nutrient and water storage, infiltration, aeration, tilth, diversity of soil organisms and to protect or improve water quality.

Consider the use of cover crops whenever possible to utilize and recycle residual nitrogen.

Consider application methods and timing that reduce the risk of nutrients being transported to ground and surface waters, or into the atmosphere. Suggestions include:

- split applications of nitrogen to provide nutrients at the times of maximum crop utilization,
- consider fall or spring nitrate-N testing to determine carry-over from previous nitrogen applications,
- avoid winter nutrient application for spring seeded crops,
- band applications of phosphorus near the seed row,
- apply nutrient materials uniformly to application areas or as prescribed by precision agricultural techniques, and/or
- immediate incorporation of land applied manure or organic by-products,
- delay field application of animal manure or other organic by-products if precipitation capable of producing runoff and erosion is forecast within 24 hours of the time of the planned application.

Consider minimum application setback distances from environmentally sensitive areas, such as sinkholes, wells, gullies, ditches, surface inlets or rapidly permeable soil areas.

Consider the potential problems from odors associated with the land application of animal manure, especially when applied near or upwind of residences.

Consider nitrogen volatilization losses associated with the land application of animal manure and urea-based fertilizer. Volatilization losses can become significant, if manure or urea are not immediately incorporated into the soil after application.

Consider the potential to affect National Register listed or eligible cultural resources (see Section I, FOTG).

Consider using soil test information no older than one year when developing new plans, particularly if animal manure is to be a nutrient source.

Consider annual reviews to determine if changes in the nutrient budget are desirable (or needed) for the next planned crop.

On sites on which there are special environmental concerns, consider other sampling techniques. (For example: Soil profile sampling for nitrogen, Pre-Sidedress Nitrogen Test (PSNT), Pre-Plant Soil Nitrate Test (PPSN) or soil surface sampling for phosphorus accumulation or pH changes.)

Consider ways to modify the chemistry of animal manure, including modification of the animal's diet to reduce the manure nutrient content, to enhance the producer's ability to manage manure effectively.

## **PLANS AND SPECIFICATIONS**

Plans and specifications shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose(s), using nutrients to achieve production goals and to prevent or minimize water quality impairment.

The following components shall be included in the nutrient management plan:

- aerial photograph or map and a soil map of the site,
- current and/or planned plant production sequence or crop rotation,
- results of soil, plant, water, manure or organic by-product sample analyses,

- realistic yield goals for the crops in the rotation,
- quantification of all nutrient sources,
- recommended nutrient rates, timing, form, and method of application and incorporation,
- location of designated sensitive areas or resources and the associated, nutrient management restriction,
- guidance for implementation, operation, maintenance, recordkeeping,
- complete nutrient budget for nitrogen, phosphorus, and potassium for the rotation or crop sequence, and
- Current and planned field risk assessments.

If increases in soil P levels are expected, plans shall document:

- the risk and probability of having to convert to phosphorus based implementation, and
- the potential to reduce phosphorus transport from the field.

When applicable, plans shall include other practices or management activities as determined by specific regulation, program requirements, or producer goals.

Plans for nutrient management shall also include:

- discussion about the relationship between nitrogen and phosphorus transport and water quality impairment. The discussion about nitrogen should include information about nitrate-N leaching into shallow ground water and potential health impacts. The discussion about phosphorus should include information about P accumulation in the soil, the increased potential for phosphorus transport in soluble form, and the types of water quality impairment that could result from phosphorus movement into surface water bodies.
- discussion about how the plan is intended to prevent the nutrients (nitrogen and phosphorus) supplied for production purposes from contributing to water quality impairment.
- a statement that the plan was developed based on the requirements of the current standard and any applicable Federal, tribal,

state, or local regulations or policies; and those changes in any of these requirements may necessitate a revision of the plan.

## OPERATION AND MAINTENANCE

The owner/client is responsible for safe operation and maintenance of this practice including all equipment. Operation and maintenance addresses the following:

- periodic plan review to determine if adjustments or modifications to the plan are needed. As a minimum, plans will be reviewed and may be revised with each soil test cycle.
- protection of fertilizer and organic by-product storage facilities from weather and accidental leakage or spillage.
- calibration of application equipment to ensure uniform distribution of material at planned rates.
- documentation of the actual rate at which nutrients were applied. When the actual rates used differ from or exceed the recommended and planned rates, records will indicate the reasons for the differences.
- Maintaining records to document plan implementation. As applicable, records include:
  - soil test results and recommendations for nutrient application,
  - quantities, analyses and sources of nutrients applied,
  - dates and method of nutrient applications,
  - crops planted, planting and harvest dates, yields, and crop residues removed,
  - results of water, plant, and organic by-product analyses, and
  - dates of review and person performing the review, and recommendations that resulted from the review.

Records should be maintained for three years or for a period longer than three years if required by other Federal, Tribal, state, or local ordinances, or program or contract requirements.

Workers should be protected from and avoid unnecessary contact with chemical fertilizers and organic by-products. Protection should include the use of protective clothing when working with plant nutrients. Extra caution must be taken when handling ammonia sources of nutrients, or when dealing with organic wastes stored in unventilated enclosures.

The disposal of material generated by the cleaning nutrient application equipment should be accomplished properly. Excess material should be collected and stored or field applied in an appropriate manner. Excess material should not be applied on areas of high potential risk for runoff and leaching.

The disposal or recycling of nutrient containers should be done according to state and local guidelines or regulations.

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